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JOINT WORKING GROUP ON DRUG DEPENDENT DEGRADATION

IN MILITARY PERFORMANCE

(JWGD^3 MILPERF)

PROGRAM SUB-ELEMENT IN-PROCESS REVIEW

(SECOND QUARTER FY 1986 MEETING)

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A Synopsis of UTC-PAB Development

Dennis L. Reeves (1)
David R. Thorne (2)

1. Naval Medical Research Institute, Bethesda, MD
2. Walter Reed Army Institute of Research, Washington D.C.

Level II Assessment Sub-Components

1. Cognitive Performance
2. Fine Motor Abilities
3. Physiological/Exercise Performance

Level II Assessment Projects/Products

1. Unified Tri-Service Cognitive Performance Assessment
   Battery (UTC-PAB)
        a. Standardized Tests
        b. Standardized Hardware/Software System
        c. Standard Operator Manuals

2. "Complex" Cognitive Performance Assessment Battery(C^2PAB)
3. Physical Exercise/Fine Motor Performance Assessment Batteri
4. Actigraph Activity Monitor
5. Residential Screening Facility (NIDA/ARC)

Level II: Baseline Assessment/Residential Screen

Objective: To conduct in-depth "baseline"
performance studies with
standardized metrics.

Note: Subjects will be in residence in a
controlled environment during screening.

Level II: Cognitive Assessment TAG

In-house Laboratories

WRAIR AAMRL   NAMRL   NIDA/ARC
ARI   USAFSAM NBDL
                NMRI
                NHRC

Project/Product

Unified Tri-Service Cognitive
Performance Assessment Battery
(UTC-PAB)

Background: The UTC-PAB is the primary instrument for the
Level II evaluation of cognitive performance.

Currently consists of 25 standardized
tests that have been designed for computer
administration and scoring.

Objective: To provide a standardized metric and operating
system that is responsive to required military
abilities and skills, and will be a sensitive
instrument for detecting performance effects
due to biomedical treatment drugs.

Development of the Unified Tri-Service Cognitive Performance Assessment Battery (UTC-PAB)

The Unified Tri-Service Cognitive Performance Assessment Battery (UTC-PAB) will serve as the primary metric during the Level II evaluation of cognitive performance in the JWGD3 MIL PERF chemical defense biomedical drug screening program. Emphasis for UTC-PAB development has been on the standardization of test batteries across participating laboratories with respect to content, computer-based administration, test scoring, and data formating. Thus far the effort has produced a 25-test UTC-PAB and standardized operating system.

Sub-components of the UTC-PAB project are as follows:

1. Design and specification of component tests
2. Development of standardized "operator" manuals
3. Hardware design and specification
4. Software design and "beta" test construction
5. Residential screening facility
6. Data base development/Networking/Central archive

Keywords:
U FLD

The UTC-PAB evolved from a three-day, JWGD3 MIL PERF sponsored workshop held in November 1984 at the Naval Medical Research Institute, Bethesda, MD. Tri-service representation in the Task Area Group (TAG) included a member from the Level I Neuropsychological TAG, two members with backgrounds in performance assessment of sustained operations, and two members specializing in information processing and workload assessment. All members had been involved in the development of automated performance assessment batteries for specific applications in applied research. The TAG objectives were:

1) to create a formula for UTC-PAB design and standardization
2) to establish a design for the standardized operating system
3) to select tests from existing inventories that met these guidelines.

The product was a blueprint for a twenty-five test UTC-PAB library that would be written in a common software language (i.e., C), and would operate on a standard family of transportable microcomputers (i.e., the IBM PC and compatibles). Test selection was based on established test validity, relevance to military performance, and sensitivity to effects of hostile environments and sustained operations. Information-processing, memory, decision-making, perception, and mental workload capacity are among the processes and abilities addressed in the battery.

Another important aspect of UTC-PAB development was the requiremen·
for standardization of the assessment instruments. Standardizator.
will: (a) provide a mechanism for a concerted "state-of-the-art"
response in a timely and cost-effective manner; and (b) provide a
basis for direct comparison and pooling of data collected from
independent research efforts.

In addition, the UTC-PAB has been designed to be a dynamic system
that will undergo several phases of evolution and allow considerable
flexibility with regard to experimental design. Built into the syste-
is the option to use and/or augment a "core" subset of tests derived
from the UTC-PAB menu (listed below), or construct an entirely unique
combination of UTC-PAB elements to meet project-specific
requirements. This capability is possible because of the dual-
component design of the software environment which includes a
Configuration System (for test and test menu construction), and a Run
Time System (for actual testing and data collection). Another
important aspect of the software system is that it has been designed
for use by non-technical operators. Specifications of both the
hardware and software systems are covered in a subsequent report (see
Hegge et. al.).

Finally, by creating a standardized battery and operating system, we
will have assembled a vehicle for establishing a network of "UTC-PAB
user" laboratories that can be linked to a central data archive. This
will create a source for rapidly establishing test norms (where
appropriate), and allow meaningful comparison of independently
derived test results.

A listing of UTC-PAB tests is presented below:

UNIFIED TRI-SERVICE COGNITIVE PERFORMANCE ASSESSMENT BATTERY

Test Name	Construct

1. Linguistic Processing
    a) Physical Letter Match
    b) Category Match
    c) Antonym Match
	Visual, Verbal-
	 Phonetic Coding

2. Grammatical Reasoning (Traditional)	Logical Reasoning

3. Grammatical Reasoning
    (Symbolic)
    a) 1 sentence / 2 symbols
    b) 2 sentences (active-positive)/
        3 symbols
    c) 2 sentences (active-negative or
        passive-negative) / 3 symbols
	Logical Reasoning

4. Two Column Addition	Number Facility

5. Mathematical Processing Task
   a) Single Operator Problems
   b) Two Operator Problems
   c) Three Operator Problems
	Number Facility;
	General Reasoning

6. Continuous Recall Task
   a) 1 digit / 1 back
   b) 2 digits / 2 back
   c) 4 digits / 4 back
	Encoding and Storage
	in Working Memory

7. 4-Choice Serial Reaction Time (Modified Wilkinson and Houghton)	Stimulus Encoding and Categorization;Response Selection and Execution
8. Alpha-Numeric Visual Vigilance Task	Sustained Choice- Reaction Time

9. Memory Search Task
(Modified Sternberg)
 	
   a) Visual-Fixed Set
     ("M" set to 100 "p" sets)
   b) Visual-Mixed Set
     (1 "M" set to 10 "p" sets) x 10
   c) Visual-Varied Set
     (1 "M" set to "p" set) x 100
   d) Auditory-Fixed Set
   e) Auditory-Mixed Set
   f) Auditory-Varied Set
	Stimulus Encoding and
	Categorization;Response
	Selection and Execution

10. Spatial Processing Task	Spatial Rotation; Short Term Memory
11. Matrix Rotation Task	Spatial Rotation; Short Term Memory
12. Manikin Test	Spatial Orientation
13. Pattern Comparison (Simultaneous)	Spatial-Perceptual Speed
14. Pattern Comparision (Successive)	Spatial-Perceptual Memory and Speed
15. Matching to Sample	Spatial Memory;Pattern Recognition
16. Item-Order Test	Short-Term Recall; Recognition

17. Visual Scanning   Visual Scanning;
    (Neisser's letter search)   Perceptual Speed

18. Code Substitution   Associative Learning;
    (a la Wechsler's digit-symbol)   Perceptual Speed

19. Visual Probability Monitoring   Spatial Scanning; Visual
    a) One dial display   Signal Detection
    b) Three dial display
    c) Four dial display

20. Time Wall   Time Estimation

21. Interval Production Task   Response Timing

22. Critical Instability Tracking Task   Manual Response Control

23. Stroop Test   Interference Suscepti-
    a) Control (Non-interference)   bility; Response Compati-
    b) Interference   bility
    c) Combined

24. Dichotic Listening   Selective Attention

25. Sternberg-Tracking Combination   Dual Task/Timesharing

Collateral support of the UTC-PAB development has involved
development of standard "operator" manuals. These manuals have
consolidated a broad range of information that includes standardized
test-administration procedures as well as an in-depth review of
relevant literature related to each of the UTC-PAB tests (the latter
includes subsections on established validity, reliability, and
sensitivity to drug effects and other stressors). Thus far, this
project has yielded manuals for 12 of the 25 tests. This effort is
being sponsored by AAMRL and will be summarized in greater detail in
a later section of the PSIPR report.

A final sub-component is the NIDA/ARC residential screening facility
which will provide several Level I/II functions. One will be as a
"proving" ground for UTC-PAB testing, i.e., individual tests will be
incorporated in ongoing drug research which will allow the
evaluation of test sensitivity and refinement of standardized testing
procedures. In addition, the ARC will serve as the initial test site
for the Level I/II residential screening of pretreatment drugs. This
effort is also summarized in more detail in a later PSIPR report.

Progress: At present standardized protocols and technical
specifications for the UTC-PAB tests have been formally defined.
Likewise, the standard operating environment has been designed and
software development is underway (beta test construction in schedule
for June FY86). Many of the participating laboratories are currently
installing the operating system and the rudiments of a laboratory
network are now in existence. "Operator" manuals have been developed
for a major portion of the tests, and our residential screening
facility (i.e., NIDA/ARC) is now operational.

In addition, a service-wide task analysis is being conducted that is
designed to provide a taxonomic inventory of processes that are
critical to combat performance. Results from this effort, the Level 1
screen, and the nature of the biomedical drugs tested will provide a
basis for refinement of the UTC-PAB library, and direct future
product improvement efforts.

Currently in-press are two UTC-PAB technical reports: one provides
detailed descriptions of the component tests; the other gives a
detailed description of hardware and software design and required
equipment specifications. To obtain reprints of these reports forward
a request to the JWGD3 Field Office at the following address:

        Director, JWGD3 MILPERF
        JWGD3 MILPERF Field Office
        10 Post Office Road
        Silver Spring, MD 20910

DISCUSSION AND COMMENTS

UTC-PAB Operating System   D. Thorne, Ph.D.

Question: Anon

What is the estimated delivery date of deliverables?
What is the cost of hardware and software to run the
system?

Response: We expect to see the first Beta test versions in
July 1986, and as soon as they are received we will put them out to the
sites so that people can start using it.

Hardware and software costs will vary.   If you get top of the
line PC's the cost will be approximately $10,000; if you cut corners
with clones you can get required hardware and software for between
$5,000 and $6,000.   These costs do not include the Nestar System.